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ABSTRACT

The impact of language of instruction (Spanish or English) during elementary school on the subsequent educational achievement of Hispanic students in high school was examined. Data from the "High School and Beyond" study, a longitudinal study of 58,000 high school sophmores and seniors, were analyzed. Three types of elementary school situations were identified: the language of instruction was either predominantly English, mixed English and Spanish, or predominantly Spanish. Students classified as limited or non-English speaking in mixed language classrooms performed better in reading and math than their peers with similar backgrounds in both predominantly English and predominantly Spanish classrooms. Students in predominantly English classrooms had reading achievement scores in the middle range and the lowest math scores. Students in predominantly Spanish classrooms had the lowest reading achievement scores. It is concluded that different languages of instruction have varying influence on educational achievement, and that dual language learning enhances general linguistic skills. (RW)

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THE IMPACT OF LANGUAGE OF INSTRUCTION ON THE EDUCATIONAL ACHIEVEMENT OF HISPANIC STUDENTS

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ABSTRACT

Based on an analysis of the High School and Beyond data base, this paper investigates the impact of language of instruction (Spanish or English) during elementary school on the subsequent educational achievement of Hispanic students in high school. Three types of situations were identified: Students during elementary school were in classrooms in which the language of instruction was either (1) predominantly English, (2) mixed English/Spanish, or (3) predominantly Spanish. Reading and Math achievement scores were employed as the dependent variables. Using regression analysis, we found that those LES/NES students in mixed language classrooms performed better in reading and math achievement than their peers with similar background in both predominantly English and predominantly Spanish classrooms. The findings here suggest that mixed-medium classrooms serve a compensatory function for LES/NES students in elementary school.

THE IMPACT OF LANGUAGE OF INSTRUCTION ON THE EDUCATIONAL ACHIEVEMENT OF HISPANIC STUDENTS

Kenyon S. Chan & Alvin Y. So

The purpose of this paper is to investigate the impact of the language of instruction on the educational achievement of Hispanic students. More specifically, it seeks to determine whether student achievement in high school is influenced by language environment in elementary school. This question has been at the center of much educational policy debate during the past several years. Proponents of bilingual education have suggested that the education of limited- or non-English speaking (LES/NES) students is enhanced if the home language is used for instruction while competence in English is being acquired. Others have suggested that using the home language for instruction impedes the acquisition of English and negatively influences school achievement.

Thus far, research on bilingual education has not produced a definitive answer to this important debate. Extant research has largely focused on theoretical typology construction or limited program evaluations. For example, while the theoretical works of Gaarder (1977), Mackey (1978), and Paulston (1975) have provided various ways of classifying bilingual education programs, their insightful theoretical frameworks have seldom been translated into empirical studies (Fishman, 1977). On the other hand, while there are many evaluation reports on bilingual programs, it is difficult to interpret the results of these studies in terms of their generalizability to the bilingual education programs across the country. Moreover, these program evaluations are often found to have serious methodological shortcomings (Baker & deKanter, 1981). Troike (1978) provided a partial list of evaluation shortcomings including:

- no control for subjects' socioeconomic status
- no control for initial language proficiency
- no baseline comparison data or control group

- inadequate sample
- insufficient data and/or statistics reported

In addition, evaluations rarely differentiate the differences in the medium of instruction in bilingual programs. Some programs may rely predominantly on the mother tongue, while others may rely predominantly on English. Still other programs may use English and the mother tongue equally in classroom instruction. Differences in the medium of instruction may play a crucial role in determining the success of a program. The result of all these research problems is a lack of methodologically sound empirical studies on the impact of bilingual education. Many researchers have repeatedly concluded that there is an absolute paucity of research on the impact of bilingual programs (Baker & deKanter, 1981; Rist, 1982; Troike, 1978).

This paper attempts to shed some light on the question of the effectiveness of bilingual education by focusing attention on the influence of language or medium of instruction in elementary school on the high school reading and mathematics achievement of LES/NES Hispanic students. Evidence for our conclusions is based on analyses of data from the High School and Beyond National Survey conducted by the National Center for Education Statistics.

The High School and Beyond Data set

The High School and Beyond (HS&B) data set is the first phase of a national longitudinal study of 58,000 students who in 1980 were sophomores and seniors. The study was conducted under contract to the National Center for Education Statistics by the National Opinion Research Center (NORC). The HS&B included a nationally representative sample of sophomores and seniors, the data from which can be projected to the national population of students in these age groups. Of particular interest to this paper, the sample design included an oversampling of Hispanic students in order to ensure a comprehensive and reliable sample of this segment of the language minority population. The weighted sample represents approximately 5.8 million students in grades

10 and 12 in 1980 (NORC, 1980). A description of the utility of the HS&B data set for the study of language minority students was recently prepared by the National Center for Bilingual Research (So, 1982).

The HS&B included data collection at a number of levels. Students were asked to complete questionnaires detailing their school experiences and future plans. Students were also administered reading and math achievement tests. All tests were administered in English. Data collected from these instruments can provide partial answers to the question of the influence of classroom language environment on school achievement. These data include comprehensive descriptions of student background characteristics. In addition to ethnic and racial origin questions, a multi-part socioeconomic indicator was included. A composite socioeconomic status (SES) variable can be constructed which includes father's occupation, father's education, mother's education, family income, and a set of questions on resources in the home such as books, daily newspaper, cars, a dishwasher, and similar items.

The HS&B data also included information on the early language background of the students. If a student reported some non-English language experience either during childhood or at the time of the HS&B survey, a comprehensive set of questions was asked related to language experience and proficiency in both English and the mother tongue.[1] From these questions it could be determined if a student's mother tongue was a language other than English, if a child was required to enroll in English classes for non-English speakers, and if the language of instruction or medium of instruction at various grade levels was English, a mix of English and the mother tongue, or the mother tongue. Approximately one-fifth of the sample, or 11,303 students, completed the language questionnaire.

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[1]Students were given the option of completing the questionnaire in English or in Spanish; only 56 out of the total student sample completed the questionnaire in Spanish. Achievement tests, however, were administered in English only.

The present analysis of the HS&B data set narrows its focus to a particular segment of the available data. First, only Hispanic students were selected for analysis. While the students answering the language questions included students from European, Asian, and other backgrounds, the Hispanic population appears to have the most comprehensive experience with a home language other than English. Further, in order to ensure that the analysis only included students who were limited- or non-English speaking at school entry, our sample included only Hispanic students who indicated Spanish as their mother tongue and who were required to take English courses for non-English speakers in elementary school. This selection decision may increase the error of excluding some LES/NES Hispanic students, but the error is in the conservative direction by decreasing the risk of including students who were English proficient at school entry and would not require compensatory language services.

Next, students were divided into three classroom language experience groups based on their answer to a question inquiring about the language of instruction in grades 1 to 6. Students were asked, "Thinking about all the courses you had in grades 1-6, how much of the teaching was done in that language?" ("that language" refers to the language other than English). Students can be divided into three categories:

- all or almost all English
- evenly mixed English/Spanish
- all or almost all Spanish

Finally, only students educated in the United States were included in the analyses. Since this is a high school age sample, the sample also included many students who only received part of their education in the United States. A fair test of the impact of some aspects of U.S. schooling should focus only on students educated in the United States.

In summary, high school reading and math achievement were employed as criteria variables while socioeconomic status and elementary school language of instruction were employed as independent variables. The sample included Hispanic students who reported mother tongue as Spanish and were required to take English courses designed for non-English speakers. This represented 30,090 sophomores and seniors in the United States in 1981. Socioeconomic status (SES) was a composite variable including a variety of social indicators. SES for the sample ranged from low to high. Medium of instruction, or language of instruction in elementary school, was divided into three categories: All or almost all English; mixed English/Spanish; and all or almost all Spanish. Population weights were used in the analysis and are reported here. Analysis of raw scores were also performed and essentially mirrored the results reported. Table 1 summarizes the sample characteristics.[2]

Table 1: Sample Characteristics of Hispanic LES/NES Students

	Socioeconomic Status			
	Low	Medium	High	Total
Medium of instruction				
All or almost all English	6,293* (122)**	1,548 (39)	87 (7)	7,929 (168)
Mixed English/Spanish	9,202 (200)	3,109 (65)	277 (9)	12,588 (274)
All or almost all Spanish	7,642 (135)	1,962 (41)	239 (5)	9,573 (181)
Total	23,137 (457)	6,619 (145)	603 (21)	30,090 (623)

*Weighted population estimates.
**The number in the parentheses represents the actual N of students in the HS&B data set.

[2]To facilitate presentation, a 3-category SES variable was used in Table 1. However, a continuous SES variable was used in the regression analysis. As a caution, it may be noted that there were only 21 cases in the high SES category in the sample. Consequently, the interpretation of the findings in the regression analysis is based mostly on students with low and medium SES.

Results

Multiple regression techniques were employed in the analysis. A separate analysis for reading and math achievement scores was conducted. The means, standard deviations and correlations of the variables in the regression equation are presented in Appendix A.

Reading Achievement

Table 2 presents the regression equations and the predicted scores for the sample by SES and medium of instruction. The coefficient in the regression equation shows the unique effect of an independent variable on reading achievement when the effects of all other independent variables have been controlled. For instance, the -6.15 coefficient for the All-Spanish variable shows that students in this type of classroom scored 6.15 points in reading achievement below those in All-English classrooms, when the effects of other variables in the equation have been accounted for. On the other hand, the +2.33 coefficient for the Mixed classroom means that students in that type of classroom scored higher than those in All-English classrooms. In this light, we can roughly assert that students in Mixed classrooms did better on reading achievement than students in All-English classrooms, who, in turn, did better than the students in All-Spanish classrooms.

However, the large coefficient (-6.73) in the interaction term (All-Spanish.SES) indicates that the effect of medium of instruction on reading achievement might vary with different socioeconomic status. To test this hypothesis, we performed a statistical significance test using the statistics from the weighted sample and the degree of freedom from the unweighted sample N (see Coleman, 1981). We found that the interaction effect between SES and language of instruction is indeed significant at 0.01 level.

To look into this interaction effect we calculated the predicted reading scores from the 3 regression equations (Table 2). Column 8 in Table 2 reveals that the effect of medium of instruction is higher for

the high SES group (12.9), but dwindles to almost nil (-0.6) for the low SES group. On the other hand, the effect of SES (column 4) is pretty strong for All-English and Mixed classrooms (13.6, 14.3), but was almost non-existent for All-Spanish classrooms (0.1).

Table 2: Regression Equations and Predicted Reading Scores for SES and Medium of Instruction Groups

The general regression equation:

Reading = 90.7 + 6.79 (SES) - 6.15 (All-Spanish) + 2.33 (Mixed) - 6.73 (All-Spanish.SES) + 0.37 (Mixed.SES)*

The regression equations for the three classrooms are:

For all or almost all English, Reading = 90.7 + 6.79 (SES)
For mixed English/Spanish, Reading = 93.03 + 7.16 (SES)
For all or almost all Spanish, Reading = 84.55 + 0.06 (SES)

Predicted Reading Score from the 3 equations:

	SES			SES Effect
Language of Instruction	Low(1)	Medium(2)	High(3)	(4)=(3)-(1)
All or almost all English (5)	83.9	90.7	97.5	13.6
Mixed English/Spanish (6)	85.9	93.0	100.2	14.3
All or almost all Spanish (7)	84.5	84.6	84.6	0.1
Instruction effect (8)=(5)-(7)	-0.6	6.1	12.9	

*Less than twice its standard error.

This interaction effect between SES and language of instruction is vividly shown in Figure 1. The LES/NES students in Mixed classrooms, regardless of their SES background, performed better than LES/NES students in predominantly English classrooms. In general, students in mixed language classrooms scored about 2 points higher than those in predominantly English language classrooms. On the other hand, LES/NES students in predominantly Spanish language classrooms did not show any

increase in reading achievement for a rise in SES background. LES/NES students in predominantly English language classrooms scored about 84.5 points at every SES level. Consequently, while the reading scores of students in predominantly Spanish language classrooms were about the same as those in predominantly English classrooms in the low SES group, the reading scores of the former group were about 6 points lower than those of the latter group in the medium SES category, and even lower than those in the high SES category.

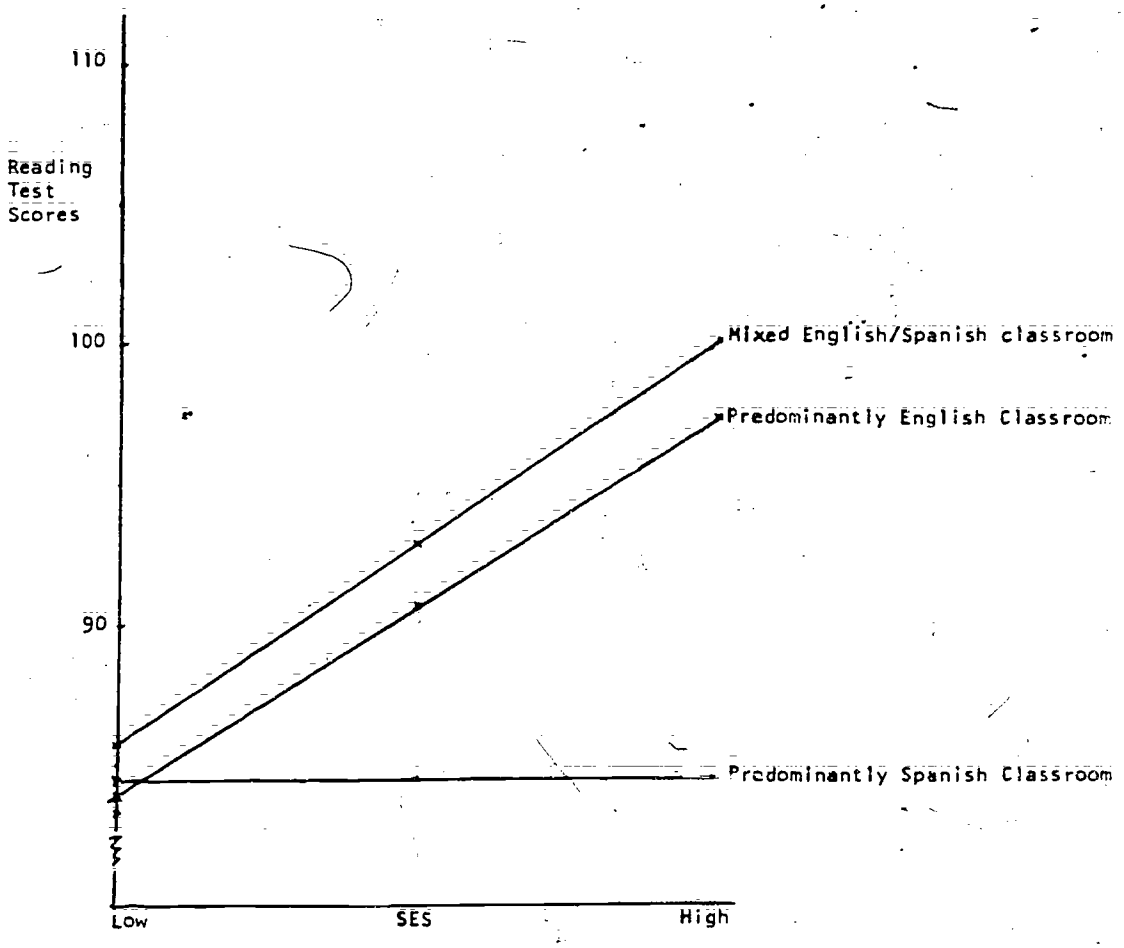

Figure 1. Predicted reading achievement and socioeconomic status for students from different classroom language environments.

Math Achievement

When we examined math achievement in Table 3, we found a different result from that for reading achievement. The positive, large coefficients of the classroom variables (+2.79, +8.32) showed that students in both All-Spanish and Mixed classrooms scored substantially higher in math achievement than those in All-English classrooms. But since the coefficient of the interaction terms was also pretty large (6.21, 5.03), we needed to see whether the interaction terms were significant or not.

Table 3: Regression Equations and Predicted Math Scores for SES and Medium of Instruction Groups

The general regression equation:

Reading = 85.51 + 0.24 (SES)* + 2.79 (All-Spanish) + 8.32 (Mixed) + 6.21 (All-Spanish.SES) + 5.03 (Mixed.SES)

The regression equations for the 3 classrooms are:

For all or almost all English, Math = 85.51 + 0.24 (SES)
For mixed English/Spanish, Math = 93.83 + 5.27 (SES)
For all or almost all Spanish, Math = 88.3 + 6.45 (SES)

Predicted Reading Score from the 3 equations:

	SES			SES effect
Language of Instruction	Low(1)	Medium(2)	High(3)	(4)=(3)-(1)
All or almost all English (5)	85.3	85.5	85.8	0.5
Mixed English/Spanish (6)	88.6	93.8	99.1	10.5
All or almost all Spanish (7)	81.9	88.3	94.8	12.9
Instruction effect(8)=(5)-(7)	3.4	-2.8	-9	

*Less than twice its standard error.

Accordingly, we performed a statistical significance test on the interaction terms. We obtained a ratio of 2.67, which was just a little short of 2.99 to be significant at 0.05 level. Since we used a conservative degree of freedom (i.e., the sample N instead of the projected population N), we thought we should not be barred by this lack of statistical significance from looking into the different patterns of math achievement among the various SES groups and classroom environments.

Table 3 shows this interaction effect based on the predicted reading scores from the 3 regression equations. Column 4 in Table 3 reveals that the effect of SES on math achievement is almost nil for those in All-English classrooms, but is quite substantial for the students in the other two types of classrooms. On the other hand, the effect of language of instruction on math achievement varied with students in each SES group. The low SES students in All-English classrooms scored higher on math tests than the low SES students in All-Spanish classrooms, but the high SES students in All-English classrooms scored much lower than the high SES students in All-Spanish classrooms. This fact is vividly illustrated in Figure 2.

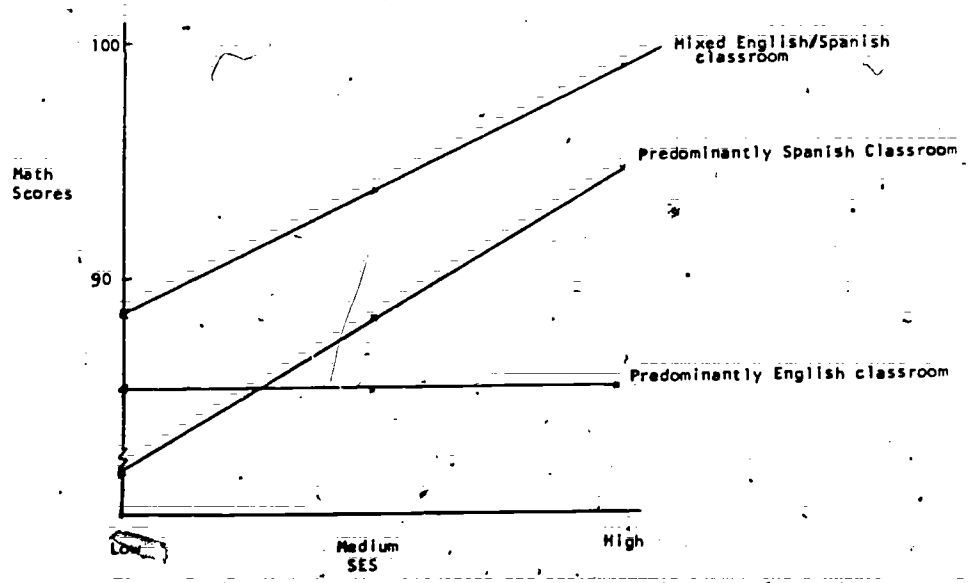

Figure 2. Predicted math achievement and socioeconomic status for students from different classroom language environments.

Discussion and Conclusions

At the beginning of this paper, it was asked whether student achievement in high school was influenced by language environment in elementary school. Using a national sample of Hispanic LES/NES students, the present analysis suggests that language of instruction in elementary school has a strong impact on a student's subsequent educational achievement.

For those LES/NES students in mixed language classrooms, it was found that their performance in reading and math achievement was superior to the performance of their peers with similar backgrounds in both predominantly English and predominantly Spanish classrooms. The findings here suggest that dual language learning enhances general linguistic abilities, as evidenced by higher reading scores. It may also be that classrooms employing both English and Spanish equally would enjoy the advantages of both languages and aid the acquisition of math skills as evidenced by higher math scores. Therefore, the above findings would support the notion that mixed-medium classrooms serve a compensatory function for LES/NES students to overcome their language disadvantages in educational achievement.

For those LES/NES students in predominantly English classrooms, their reading achievement scores were in the middle, but their math achievement scores were the lowest of the three groups. One might speculate that mathematics achievement requires rudimentary math concepts and skills. In addition, certain language skills are also required since mathematics problems are often embedded in language comprehension. Therefore, for LES/NES students, if the medium of instruction is primarily in English, then the acquisition of rudimentary mathematics concepts will be inhibited since LES/NES children may not have adequate English language skills to benefit from the instruction.

For those LES/NES students in predominantly Spanish classrooms, their reading achievement was the lowest of the three groups. This suggests that all-Spanish classroom instruction may have a debilitating effect on the reading achievement of LES/NES students. It seems that while total immersion in predominantly English classrooms was not conducive to high reading achievement, total immersion in predominantly Spanish classrooms was not beneficial either. With respect to math achievement, LES/NES students from low SES backgrounds in predominantly Spanish classrooms again scored the lowest of the three groups. This suggests that if Spanish was the predominant language of instruction, then perhaps the acquisition of English language skills necessar to disembed mathematics problems may have been inhibited. However, LES/NES students from medium and high SES backgrounds in predominantly Spanish classrooms were able to convert their SES advantages into higher math achievement scores. Further research can address this interesting interaction between SES and math achievement.

The above discussion suggests that different types of medium of instruction have differential impact on educational achievement. Classrooms with equally mixed language instruction exert a compensatory effect on educational achievement, while the classrooms with predominantly Spanish or English instruction in general do not produce such a positive impact. Consequently, in discussing the impact of medium of instruction it is necessary to differentiate the compensatory effect of a mixed language classroom from the intricate effect of monolingual classrooms.[3]

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[3] It may be noted that the findings also incidentally show that an ESL class is not sufficient to overcome the educational disadvantages of LES/NES Hispanic students. For the same group of LES/NES Hispanic students who enrolled in ESL classes, the findings here show that a bilingual medium of instruction still made a substantial impact on educational achievement. In this respect, bilingual medium of instruction may perform a function that cannot be substituted by ESL classes.

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Appendix A. Correlations, Means, and Standard Deviations of the Variables in the Regression Equation

	Reading	Math	SES	Mixed	Spanish	Mixed.SES	Spanish.SES
Reading	1.00	0.43	0.18	0.08	-0.05	0.07	0.04
Math	----	1.00	0.18	0.17	-0.15	-0.04	0.21
SES	----	----	1.00	0.06	0.06	0.40	0.43
Mixed	----	----	----	1.00	-0.57	-0.71	0.43
Spanish	----	----	----	----	1.00	0.40	-0.76
Mixed.SES	----	----	----	----	----	1.00	-0.31
Spanish.SES	----	----	----	----	----	----	1.00
Mean	85.73	86.17	-0.84	0.41	0.32	-0.32	-0.29
Standard Deviation	15.87	16.46	0.61	0.49	0.47	0.55	0.55